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Does an interdisciplinary outpatient atrial fibrillation (AF) clinic affect the number of acute AF admissions? A retrospective cohort study

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ABSTRACT

Aims and objectives
To investigate the impact of a multidisciplinary outpatient clinic for patients with atrial fibrillation (AF-clinic) on the number of acute hospitalizations for atrial fibrillation compared with usual outpatient care for this condition before the establishment of the AF-clinic.
Background
Guidelines recommend a structured outpatient clinic follow-up in multidisciplinary teams for patients with atrial fibrillation due to fewer hospitalizations and death. However the evidence base is weak.

Design
The study is a retrospective cohort study including a total of 129 patients from the cardiac outpatient clinic at a large Danish University Hospital. The study population consisted of two groups: a usual care group before a dedicated AF-clinic was established (n=73) and the AF-clinic group (n=56). The primary endpoint was acute hospitalization for AF.

Methods
Cox regression was used to assess the hazard ratio for acute hospitalizations for atrial fibrillation.

Results
When comparing the AF-clinic with the usual care group, adjusted for age and sex, this study showed a trend towards more frequent acute hospitalizations in the usual care group.

Conclusion
The results of this study are hypothesis-generating and should lead to larger prospective trials to evaluate the impact of dedicated multidisciplinary AF-clinics on atrial fibrillation-related issues as acute hospitalizations for atrial fibrillation, symptoms and quality of life.

Keywords
Atrial fibrillation, AF-clinic, hospitalization, Multi professional care, Clinical nurse specialist.

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SUMMARY BOX

What does this paper contribute to the wider global clinical community?

- This study showed that after establishment of an AF clinic there is a trend towards fewer acute hospitalizations due to atrial fibrillation.

- Follow-up in a dedicated multidisciplinary AF clinic might empower patients better to cope with acute arrhythmia symptoms.

INTRODUCTION

Background

Atrial fibrillation is the most common cardiac arrhythmia with a prevalence of 1-2 % in the general population, which increases with age (Camm et al., 2010). At the present time approximately 10 million Europeans have atrial fibrillation and about 100,000-200,000 new-onset atrial fibrillation. These figures are expected to rise to 14-17 million and 120,000-215,000 new atrial fibrillation cases per year by 2030 (Zoni-Berisso et al., 2014).

In Denmark, 7000 patients are diagnosed with atrial fibrillation every year and for people over the age of 40, the risk of developing AF doubles with each decade. In 2009, approximately 64,000 patients in Denmark were living with atrial fibrillation and it is expected that three times as many will be affected by 2050. Atrial fibrillation results in increased morbidity and mortality. The complications are serious and if untreated, atrial fibrillation can lead to heart failure, stroke and early death (J. M. Hendriks et al., 2012).
The Euro Heart Survey on atrial fibrillation, comprising 5,333 patients from 31 European countries, investigated whether patients with atrial fibrillation were treated optimally based on current European treatment guidelines. The investigators found that patients were often insufficiently treated due to a lack of adherence to these guidelines and concluded that if patients received guideline-adherent treatment both morbidity and mortality would be reduced (Nieuwlaat et al., 2006; Nieuwlaat et al., 2007; J. M. Hendriks et al., 2012).

Previous studies have shown that multidisciplinary heart failure clinics guided by nurses improved clinical outcomes in patients (Rich et al., 1995; Phillips et al., 2004). Furthermore, a Dutch study has shown that a chronic care program led by nurses led to better guideline adherence (J. L. Hendriks et al., 2010).

A Dutch randomized clinical trial of 712 patients to investigate whether a multidisciplinary controlled AF-clinic compared to a general outpatient control resulted in better treatment guidelines adherence was initiated in 2007. The study documented that a nurse-led AF-clinic reduced both the number of readmissions, the risk of stroke, and cardiovascular death. The study also showed that patients were better informed about their disease and knew how to handle it (J. M. Hendriks et al., 2012).

Studies have shown that atrial fibrillation patients experience debilitating physical and mental effects resulting in reduced quality of life. Patients often experience many different doctors and nursing staff members during their hospital stay and are often discharged before they are ready; leaving them with limited knowledge of their condition despite the information given during their hospital stay (Kirchhof et al., 2016).
The literature on the impact of AF-clinics on acute hospitalizations for atrial fibrillation is sparse. We, therefore, sought to investigate, whether establishment of a multidisciplinary AF outpatient clinic reduces the number of acute hospitalizations for atrial fibrillation.

THE STUDY

Aim
The aim of the study was to investigate the impact of a multidisciplinary outpatient clinic for patients with atrial fibrillation (AF-clinic) on the number of acute hospitalizations for atrial fibrillation, compared with usual outpatient care for this condition before the establishment of the AF-clinic.

METHODS

Design
We conducted a retrospective cohort study in outpatients with new-onset atrial fibrillation at a large University Hospital.

Participants
The entire cohort consisted of a patient group referred before the establishment of a dedicated AF-clinic (from September 1, 2010 to August 31, 2011) receiving usual care (usual care group) and the AF-clinic group (from September 1, 2013 to August 31, 2014).
Patients were eligible for inclusion, if they had newly-diagnosed atrial fibrillation and a comprehensive ambulant consultation including echocardiography (either transthoracic (TTE) or transesophageal (TEE)). Patients, who had previously experienced a single self-terminating episode of atrial fibrillation not requiring treatment or where atrial fibrillation and atrial flutter could not be distinguished, were also eligible.

Exclusion criteria: information visit prior to radiofrequency ablation, previous treatment of atrial fibrillation, common flutter, if this was the only documented arrhythmia.

**Ethical considerations**

The study complies with the Declaration of Helsinki and was approved by Danish Data Protection Agency and the Danish Board of Health. Prior approval from the Scientific Ethical Committees in Denmark is not required as this is a retrospective study analysing existing data from patient records.

**Management Strategies in the two populations**

Patients in the usual care group had an outpatient appointment of 30 minutes duration with a doctor affiliated with the clinic. There was no in advance-strategy for how often patients should be seen by a doctor, which was not necessarily a specialist in cardiology. Patients with several appointments at the outpatient clinic could meet different doctors at each appointment (16).
In the AF-clinic, the first appointment lasts 45 minutes and is with an arrhythmia specialist. Beyond a detailed medical history a 12-lead ECG and an echocardiography is performed in all patients, a detailed treatment plan made, and detailed information on AF and the specific treatment plan is provided. The follow-up visits are with a nurse specialist, the first time usually after three months. The nurses take a history since the last visit, the patients’ pulse and blood pressure, and a 12-lead ECG. Blood samples are taken as appropriate. Guidance and education of patients and their families are important for treatment and, thus, a strategic priority for the follow-up visits. Patients are instructed and trained to better understand their disease, including how they can cope with it. The goals for treatment are that patients become more observant in their disease and respond appropriately to deteriorations or changes in their atrial fibrillation. The nurse also follows up on the treatment plan and makes necessary adjustments. This is done in close collaboration between the nurse specialist and the arrhythmia specialist, who continuously discuss the individual treatment plans to optimize the patient’s treatment strategy. For every single patient the number of follow-up visits is determined based on the patient’s specific needs. To provide continuity, each patient is seen by the same specialist and one of two nurse specialists.

Data analysis

Data for the two groups were obtained from the hospital’s patient administrative system and from the patients’ electronic medical records. A codebook was made in relation to obtaining the variables. Data were entered into a database (Microsoft Excel 2010) and subsequently analyzed using STATA version 13.
Continuous variables are reported as mean if data were normally distributed, and as median and interquartile range (IQR), if data were not normally distributed. Significance was tested using Student’s t-test and Wilcoxon Mann-Whitney U-test where appropriate. Categorical variables were presented as frequencies (%) and significance tested using $\chi^2$-test and Fisher’s exact test where appropriate. A two-sided p-value < 0.05 was considered statistically significant.

The outcome (acute hospitalization for atrial fibrillation) was analyzed with the use of time-to-event methods. A Kaplan-Meier plot was calculated for acute hospitalizations for atrial fibrillation in both groups. To control for age and gender a Cox proportional hazards model was used.

RESULTS

Seventy-three patients in the usual care group and 56 patients in the AF-clinic group met the inclusion criteria. Table 1 presents the baseline characteristics of the entire study population and the usual care and AF-clinic group, respectively. A total of 129 patients, 62.8 % males, with a median age of 70 (IQR 63 – 76) years were included, 73 in the usual care group and 56 in the AF-clinic group.

More than 50 % of the patients in the usual care group had at least one outpatient visit; about 25 % had two and 20 % three or more. Only very few patients had a telephone contact with the outpatient clinic. Eight patients (11.0 %) in the usual care group were
acutely admitted to hospital with atrial fibrillation whereas this was the case for two patients (3.6 %) in the AF-clinic group. In the usual care group three out of the eight patients, who were acutely admitted with atrial fibrillation, were also ablated during the observation period, and one was acutely hospitalized after the ablation procedure. One patient in the usual care group had an operation and acute hospitalization three months before inclusion. Both groups had similar comorbidities. However, there were significantly more patients with diabetes in the AF-clinic group (19.6 % vs. 6.9%, P=0.029). In the entire population 78.3% had a CHA\textsubscript{2}DS\textsubscript{2}-VASc score ≥ 2, but it is important to note, that the usual care group was treated according to the CHADS\textsubscript{2} score, as the CHA\textsubscript{2}DS\textsubscript{2}-VASc score was not fully implemented at that time. The CHA\textsubscript{2}DS\textsubscript{2}-VASc score assessed the thromboembolic and bleeding risk factors (Congestive heart failure, Hypertension, Age ≥ 75 years, Diabetes, previous Stroke, Vascular disease, Age 65-74 years, Sex category). The ejection fraction was normal in the vast majority (93.0%). In the usual care group two out of the eight patients with an acute hospitalization had heart failure.

Table 2 shows the medical treatment used in the two groups. The majority of patients were treated with beta-blockers (70.5%). It is also worth to note that significantly more patients in the usual care group were treated with digoxin compared with the AF-clinic group (24.7% vs. 8.9%, P=0.021). Significantly more patients in the usual care group were treated with warfarin (65.8% vs. 37.5%, P=0.001), while more patients in the AF-clinic group received NOAC (48.2% vs. 1.4%, P<0.001). It is also important to note that the total number of patients on oral anticoagulants had increased in the AF-clinic group compared with the usual care group. At the same time, there were significantly fewer patients receiving
antiplatelet drugs in the AF-clinic group (16.1% vs. 43.8%, P=0.001). Furthermore, significantly more patients in the AF-clinic group were treated with statins compared to the usual care group (50% vs. 30.1%, P=0.022).

Acute hospitalizations

Figure 1 shows the Kaplan-Meier survival estimates for acute atrial fibrillation hospitalizations in the two groups. The event seemed to occur early during follow-up in the usual care group compared with the AF-clinic group. There were also slightly more patients in the usual care group, who were hospitalized due to atrial fibrillation. The curves were assumed to be proportional, knowing that there were limitations due to the small data set. There was a non-significant trend towards lower risk of acute hospitalizations for atrial fibrillation in patients, who were followed at the AF-clinic compared to usual care, which was unchanged after adjustment for age and gender (Table 3). Further adjustments did not change the result.

To account for death as a competing risk a Fine Gray model was used. The sub hazard ratios did not change (0.36 (95% CI 0.08 to 1.65; p = 0.188)). Figure 2 shows the respective Kaplan Meyer curves.

DISCUSSION

The association between a multidisciplinary AF-clinic and a lower risk of an acute hospitalization for atrial fibrillation has not previously been studied in Denmark. The main result of this study was that, irrespective of age and gender, there was no statistically significant difference in acute hospitalizations for atrial fibrillation after introduction of the
AF-clinic, compared with usual outpatient care (table 3). Nevertheless, there were slightly more patients in the usual care group with an acute hospitalization for atrial fibrillation.

A prospective randomized Dutch study of 712 patients showed that a multidisciplinary AF-clinic led to better outcomes of patients with atrial fibrillation than an ordinary outpatient clinic (J. M. Hendriks et al., 2012). The primary endpoint of this study was a composite of cardiovascular death and cardiovascular hospitalizations, including acute hospitalization for atrial fibrillation. The enrolled patients were younger with a mean age of 66 and 67 years in the two groups. Moreover, they were more selected with regard to co-morbidities, as these were stable and controlled, and patients with severely reduced systolic LV function as well as those hospitalized three months prior to enrollment were excluded. In the present study presenting retrospective “real-world” data, all newly-diagnosed and newly-referred patients with atrial fibrillation were included regardless of their co-morbidities, including patients with heart failure or surgery three months prior to their first outpatient visit. We also included newly-diagnosed patients who were referred after their acute hospitalization with atrial fibrillation.

Other previous studies have shown a higher rate of hospitalization in atrial fibrillation patients managed with rhythm control compared to frequency control strategy (Hagens et al., 2004; Marshall et al., 2004). In the Dutch study, there was no information as to an imbalance in the treatment approach of the two groups (J. M. Hendriks et al., 2012). The Danish guidelines recommend that patients are treated individually in terms of rhythm or
frequency control, taking into account various factors such as symptoms, risks and the frequency of periods with atrial fibrillation (Kirchhof et al., 2017). In this study treatment strategy in the two periods may have had an impact on the outcome (Gordis, 2014). Consumption of Digitalis was found significantly higher in the historical group (frequency control strategy) whereas more patients in the AF-clinic group were treated in terms of medical rhythm control. The numbers of DC conversions was not registered, why it was not possible to conclude whether there was a difference in treatment strategies in the two groups. The results shows however that after introduction of the AF-clinic, more attention has been given due to patient’s symptoms and therefore more patients have been treated with the medical rhythm control strategy.

Another significant finding in this study was the differences in treatment with anticoagulants. In the usual care group significantly more patients were treated with antiplatelet drugs and warfarin, while more NOACs were used in the AF-clinic. This finding likely reflects a change of treatment over time due to introduction of new drugs and guidelines (Gordis, 2014).

Scientific literature indicates that patients who are well informed about their illness better manage their symptoms, which among other things, can reduce the number of acute hospitalizations with AF (McCabe, 2011; J. M. Hendriks et al., 2012; Lee, 2013; J. M. Hendriks et al., 2014). In this study, there was a slight increase of patients that had their second visit to the AF-clinic (26.8 %) compared to the usual care group (24.7 %). In the AF-clinic nurse specialists’ targeted information and guidance to patients which could have a significant bearing on the number of acute atrial fibrillation hospitalizations.
Limitations

This study has some limitations. First, it is a retrospective study in a quite small number of patients. Second, there was a group of 61 newly diagnosed atrial fibrillation patients, who were followed by several other physicians outside the AF-clinic and therefore, excluded from the analysis.

CONCLUSION

This study showed that overall there was no statistically significant difference in acute hospitalizations for atrial fibrillation, regardless of age and gender, after establishment of the AF-clinic compared with the usual care group (HR 0.37; 95 % CI (0.08 to 1.81); P=0.222). However, there was a trend towards more acute atrial fibrillation hospitalizations in the usual care group compared with the AF-clinic group. Larger prospective trials are necessary to evaluate the impact of a specialized AF-clinic on hospitalizations for atrial fibrillation.

RELEVANCE TO CLINICAL PRACTICE

Follow-up in a dedicated multidisciplinary AF-clinic might empower patients better to cope with acute arrhythmia symptoms.
REFERENCES


rate control in atrial fibrillation. *Annals of Internal Medicine*, 141(9), 653-661.


Table 1 Baseline characteristics

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Total N = 129</th>
<th>Usual care group (September 2010 – August 2011) (n= 73)</th>
<th>AF-clinic group (September 2013 – August 2014) (n= 56)</th>
<th>P-value Usual care group vs. AF clinic group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, years</td>
<td>70 [63-76]</td>
<td>70 [61-76]</td>
<td>69.5 [63.5-76.5]</td>
<td>0.829</td>
</tr>
<tr>
<td>Women, n (%)</td>
<td>48 (37.2)</td>
<td>25 (34.3)</td>
<td>23 (41.1)</td>
<td>0.427</td>
</tr>
<tr>
<td>Death, n (%)</td>
<td>4 (3.1)</td>
<td>2 (2.7)</td>
<td>2 (3.6)</td>
<td>1.000</td>
</tr>
<tr>
<td>Outpatient visits, n (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 (†)</td>
<td>70 (54.3)</td>
<td>41 (56.2)</td>
<td>29 (51.8)</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>33 (25.6)</td>
<td>18 (24.7)</td>
<td>15 (26.8)</td>
<td></td>
</tr>
<tr>
<td>≥3</td>
<td>26 (20.2)</td>
<td>14 (19.2)</td>
<td>12 (21.4)</td>
<td></td>
</tr>
<tr>
<td>Telephone contacts (initiated by the patient), n (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>125 (96.9)</td>
<td>70 (95.9)</td>
<td>55 (98.2)</td>
<td>0.632</td>
</tr>
<tr>
<td>≥1</td>
<td>4 (3.1)</td>
<td>3 (4.1)</td>
<td>1 (1.8)</td>
<td></td>
</tr>
<tr>
<td>Acute hospitalizations with AF, n (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>119 (92.25)</td>
<td>65 (89.0)</td>
<td>54 (96.5)</td>
<td>0.185</td>
</tr>
<tr>
<td>≥1</td>
<td>10 (7.75)</td>
<td>8 (11.0)</td>
<td>2 (3.6)</td>
<td></td>
</tr>
<tr>
<td>Cardiac surgery within 3 month before the first outpatient visit</td>
<td>7 (5.53)</td>
<td>4 (5.48)</td>
<td>3 (5.36)</td>
<td>1.000</td>
</tr>
<tr>
<td>Ablation during the observation period</td>
<td>3 (2.33)</td>
<td>3 (4.11)</td>
<td>0 (0.00)</td>
<td>0.257</td>
</tr>
<tr>
<td>Comorbidities, n (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hypertension^A</td>
<td>76 (58.9)</td>
<td>39 (53.4)</td>
<td>37 (66.1)</td>
<td>0.148</td>
</tr>
<tr>
<td>Diabetes mellitus^B</td>
<td>16 (12.4)</td>
<td>5 (6.9)</td>
<td>11 (19.6)</td>
<td><strong>0.029</strong></td>
</tr>
<tr>
<td>Heart diseases^C</td>
<td>16 (12.4)</td>
<td>10 (13.7)</td>
<td>6 (10.7)</td>
<td>0.610</td>
</tr>
<tr>
<td>Stroke/systemic embolia^D</td>
<td>36 (27.9)</td>
<td>17 (30.4)</td>
<td>17 (30.4)</td>
<td>0.587</td>
</tr>
<tr>
<td>Other^E</td>
<td>20 (15.5)</td>
<td>15 (20.6)</td>
<td>5 (8.9)</td>
<td>0.071</td>
</tr>
<tr>
<td>CHA₂DS₂Vasc-score, n (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>14 (10.9)</td>
<td>9 (12.3)</td>
<td>5 (8.9)</td>
<td></td>
</tr>
<tr>
<td>= 1</td>
<td>14 (10.9)</td>
<td>11 (15.1)</td>
<td>3 (5.4)</td>
<td></td>
</tr>
<tr>
<td>≥2</td>
<td>101 (78.3)</td>
<td>53 (72.6)</td>
<td>48 (85.7)</td>
<td></td>
</tr>
<tr>
<td>Left ventricular ejection fraction (LVEF), n (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EF ≤ 44 % (Heartfailure)</td>
<td>9 (7.0)</td>
<td>5 (5.9)</td>
<td>4 (7.1)</td>
<td></td>
</tr>
<tr>
<td>EF ≥ 45 % (Normal EF)</td>
<td>120 (93.0)</td>
<td>68 (93.1)</td>
<td>52 (92.9)</td>
<td>1.000</td>
</tr>
</tbody>
</table>
Table 2 Medication

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Total N = 129</th>
<th>Usual care group September 2010 – August 2011 (n= 73)</th>
<th>AF-clinic group September 2013 – August 2014 (n= 56)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment, n (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beta-blockers</td>
<td>89 (69.0)</td>
<td>53 (72.6)</td>
<td>36 (64.3 )</td>
<td>0.311</td>
</tr>
<tr>
<td>Class 1C antiarrhythmic drugs</td>
<td>4 (3.1 )</td>
<td>0 (0.0)</td>
<td>4 (7.1 )</td>
<td>0.020</td>
</tr>
<tr>
<td>Class 3 antiarrhythmic drugs</td>
<td>4 (3.1 )</td>
<td>1 (1.4 )</td>
<td>3 (5.4 )</td>
<td>0.195</td>
</tr>
<tr>
<td>Digoxin</td>
<td>23 (17.8)</td>
<td>18 (24.7)</td>
<td>5 (8.9)</td>
<td>0.021</td>
</tr>
<tr>
<td>Other medical treatment, n (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Angiotensin II antagonists</td>
<td>21 (16.3)</td>
<td>8 (11.0)</td>
<td>13 (23.2)</td>
<td>0.062</td>
</tr>
<tr>
<td>Angiotensin-converting enzyme (ACE-) inhibitors</td>
<td>32 (24.8)</td>
<td>18 (24.7)</td>
<td>4 (25.0)</td>
<td>0.964</td>
</tr>
<tr>
<td>Calcium antagonists</td>
<td>29 (22.5)</td>
<td>14 (19.2)</td>
<td>15 (26.8)</td>
<td>0.305</td>
</tr>
<tr>
<td>Diuretics</td>
<td>42 (32.6)</td>
<td>24 (32.9)</td>
<td>18 (32.1)</td>
<td>0.930</td>
</tr>
<tr>
<td>Statins</td>
<td>50 (38.8)</td>
<td>22 (30.1)</td>
<td>28 (50.0)</td>
<td>0.022</td>
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<tr>
<td>Warfarin</td>
<td>69 (53.5)</td>
<td>48 (65.8)</td>
<td>21 (37.5)</td>
<td>0.001</td>
</tr>
<tr>
<td>Antiplatelet drugs</td>
<td>41 (31.8)</td>
<td>32 (43.8)</td>
<td>9 (16.1)</td>
<td>0.001</td>
</tr>
<tr>
<td>NOAC (non-vitamin K antagonist oral anticoagulant)</td>
<td>28 (21.7)</td>
<td>1 (1.4)</td>
<td>27 (48.2)</td>
<td>&lt; 0.001</td>
</tr>
</tbody>
</table>
Table 3 Results from the Cox proportional hazard regressions

<table>
<thead>
<tr>
<th>Model</th>
<th>Hazard ratio</th>
<th>95% CI</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unadjusted</td>
<td>0.361</td>
<td>0.08 - 1.74</td>
<td>0.204</td>
</tr>
<tr>
<td>Adjusted for age</td>
<td>0.383</td>
<td>0.08 - 1.85</td>
<td>0.233</td>
</tr>
<tr>
<td>The final model adjusted for age and gender</td>
<td>0.374</td>
<td>0.08 - 1.81</td>
<td>0.222</td>
</tr>
</tbody>
</table>
Tables:
Table 1 Baseline characteristics
Table 2 Medication
Table 3 Results from the Cox proportional hazard regressions

Figure legends:
Figure 1: Kaplan-Meier survival estimates due to acute hospitalizations with AF in the two groups
Figure 2: Competing risks regression – accounting for death
Figure 1. Kaplan-Meier survival estimates due to acute hospitalizations with AF in the two groups.
Figure 2. Competing risks regression - accounting for death.